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PROJECT COMPLETION REPORT

GRAND PRAIRIE WATER SUPPLY PROJECT

PHASE I

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GRAND PRAIRIE WATER SUPPLY PROJECT - PHASE I

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INTRODUCTION

On the Grand Prairie, rice has required irrigation. Present day economics are favoring irrigation for soybeans as well. Water needs are currently being filled primarily from three sources: rainfall, a Tertiary aquifer and a Quaternary aquifer. Rainfall and rainfall storage meet some of the total water needs. The Tertiary aquifer lies at depths of 750 to 1400 feet beneath the surface of the Grand Prairie. Some water is obtained from the formation, but the outlook for significantly increasing withdrawals is bleak because of the cost involved in drilling new wells. Roughly seventy-five percent of the irrigation water needs are met by withdrawal from the Quaternary aquifer underlying the prairie. A relatively impervious clay layer lies between the ground surface and the aquifer. Therefore recharge to the study area occurs primarily from the extended aquifer lying outside the area boundaries and from some reaches of the White River and Bayou Meto. Withdrawal of groundwater has exceeded recharge. The result is that the groundwater levels have been dropping significantly. Increasing pumping distances and escalating energy costs are creating some economic difficulties for the farmers of the area. However, the major problem is the difficulty of obtaining sufficient water.

There is little prospect of extensive municipal or industrial expansion in the Grand Prairie. Nor is the economic base for funding water projects likely to significantly expand. It is therefore assumed that some level of sustained yield is desirable for the aquifer. Several sustained yield pumping strategies will eventually need to be compared and the most desirable one selected. The first step in the process is to calibrate a simulation model of the aquifer. This report describes the assumptions and results of the calibration and makes recommendations for future work.

OBJECTIVES

1. Develop the data bank needed to calibrate and validate a generalized groundwater model to simulate water levels in the Grand Prairie Quaternary aquifer.

2. Test the generalized computer model (calibration, validation and sensitivity analysis) as to suitability for water management on the Grand Prairie.

PROCEDURES AND RESULTS

Introduction

As previously stated, the objectives of the Grand Prairie Water Supply Project include the selection of a particular sustained yield pumping strategy. Thus the simulation model selected needed to be one which would be especially useful for that task. Using most finite difference or finite element models, that process would be a tedious one. The model which was selected for this study is based on linear theory (15). This makes available a relatively simple procedure for later use in developing sustained yield pumping strategies (19).

Another goal of the overall effort is minimization of cost of supplied water to the Grand Prairie. The linear characteristics of the model offer opportunities for linear systems optimization which would be lacking in most other simulation programs.

The study area is shown in Figure 1. It is bounded by the Arkansas River on the South, the White River on the East, and the Bayou Meto to the Southwest. The boundaries do not always follow the rivers and streams in the North because the streams probably do not penetrate to the aquifer in that region. The aquifer is unconfined in the center of the study area and confined near the periphery.

The simulation model employs a grid of equal spacing in the X and Y directions.[1] Because of the high cost of simulation runs using a finer grid spacing, a spacing of three miles was used. Constant head cells were used along the entire study area boundary. An impermeable barrier is assumed to exist between the constant head cells and area outside the study district.

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[1] The terrain encompassed by each cell is not the same as that covered by a quarter township, although the area is the same size. This was done intentionally. It is desirable to have accurate knowledge of aquifer characteristics in each cell. Such data is generally obtained from the records of well construction. Wells are usually drilled along roads (i.e. along township borders, etc.) rather than in the center of the township. Thus knowledge of the top and bottom of the aquifer and spring water levels are more likely to be available for the edges than the center of townships. One hopefully assumes that the characteristics in the center of the cell are representative of the average values for that cell. Therefore, an offset grid was used in which the centers of the cells lie on the township and quarter township borders.

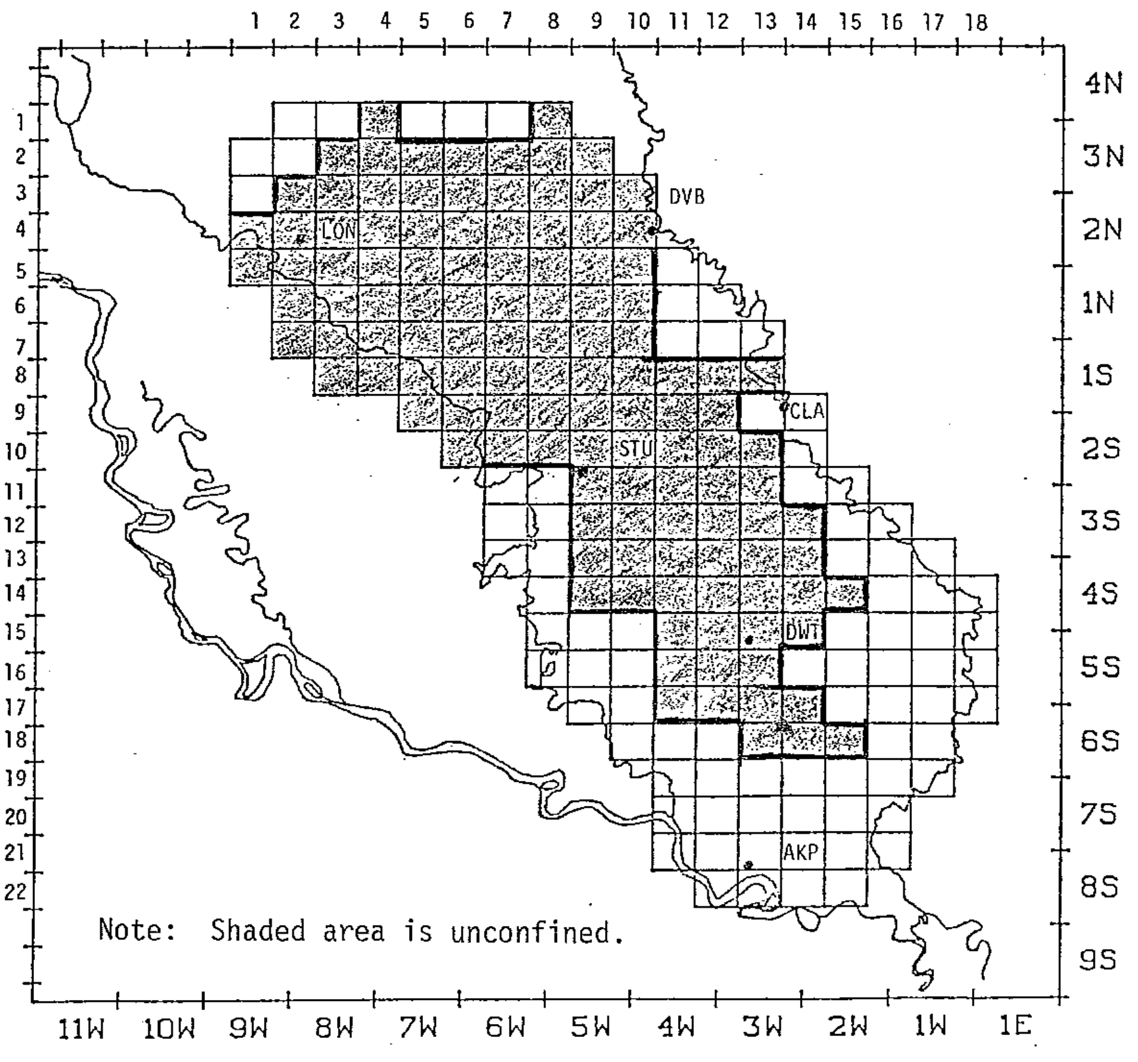

Figure 1: Grand Prairie Study Area.

Data Bank Development

Introduction

Simulation of groundwater levels in an area the size of the Grand Prairie requires the use of a great deal of data. A number of assumptions had to be made to generate this data. These assumptions are reported where appropriate in the following sections.

Estimation of Aquifer Descriptors

The elevations of the top and bottom of the Quaternary aquifer in the center of each 3 mile x 3 mile cell was estimated from existing maps (5,9). (These elevations often vary by 20 feet from place to place in the same cell.) For simplicity, the aquifer was assumed to be homogeneous and isotropic. The storage coefficient of the aquifer had been reported by Sniegocki (14) to be 0.3. Broom and Lyford (6) used this successfully as the specific yield in modeling another part of the same aquifer. This same value was used globally as an estimate of effective porosity in this work[1]. Engler, et al (10) had reported a permeability of 1900 gpd (254 ft/day per square foot). Sniegocki (14) reported a value of 2000 gpd per square foot (267 ft/ day). Broom and Lyford (6) obtained best results when using a hydraulic conductivity of 270 ft/day in their simulation. The particle size increases with depth in the Grand Prairie Quaternary aquifer. As particle size increases, so does hydraulic conductivity. Since the aquifer has been somewhat dewatered since Engler's report, the higher value of 270 ft/day was selected as being more appropriate for the calibration period. Transmissivities for each cell in the study area were obtained by multiplying the hydraulic conductivity by the distance between the bottom of the aquifer and the 1972 ground water level or the top of the aquifer, whichever was lower at that point. These values are found in Appendix A.

Estimation of Pumping from and Recharge to the Quaternary Aquifer

The major users of Quaternary groundwater in the Grand Prairie are agriculture, aquaculture and municipalities. Estimates were made of the amount of pumping from the Quaternary aquifer which had occurred during the calibration period (1972-1982). This amount

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1 In one simulation run the effective porosity was spatially varied to manifest locations of suspected confinement. The results of that effort were not as good as those from simulations using a constant effective porosity of 0.3. That run is reported at the end of the Results section.

varied from year to year depending on aquacultural, rice and irrigated soybean acreages, and climatological differences. Pumping from the aquifer is considered as a positive value. Water moving into the aquifer in cells other than constant head cells is considered as a negative pumping value. Pumping in constant head cells does not affect simulation results. Therefore, for simplicity, all constant head cells may have zero pumping or recharge. The following paragraphs indicate how the pumping values were developed.

Estimating agricultural pumping is a challenge since records are not available containing this information. The procedure used to approximate it can most easily be explained as follows. The 1972 Natural Resource Inventory System and Land Use Data Information System data bases contain the dominant land use of every square kilometer in the study area. [This data is reported in a series of publications by the Arkansas Department of Local Services (2, 11,12,13). The 1977 RIDS data base was not used because only one square kilometer out of every 10 was sampled in that survey.] USDA's Crop Reporting Service reports total acreages of rice and soybeans as well as data which can be used to estimate total agricultural acreage (1). All of the rice acreage was assumed to be irrigated and 29% of the soybean acreage was assumed to be irrigated. This 29% was the average figure used by the USGS for Arkansas, Lonoke, and Prairie counties for 1975 and 1980 (17,18).

Information from these two data bases was used to provide an estimate of irrigated rice and soybean acreages in each cell of the study area. This value varied from year to year within the calibration period. Climatological data (7) combined with a knowledge of average irrigation water needs and application efficiencies, was used to provide estimates of the amount of irrigation water required for rice or soybeans needed in each specific year of the calibration period. The percentage of each county's total water requirement obtained by pumping from the Quaternary aquifer was derived from figures reported by the USGS (17,18). These percentages are 51% for Arkansas, 87% for Lonoke, 93% for Monroe, and 72% for Prairie county. The product of the rice acreage; rice irrigation water needs; and percentage of those needs coming from the Quaternary (all for a particular year and cell) is the amount of water pumped for rice from the Quaternary in that particular year and cell. This amount plus an analogous amount for soybeans represents the total agricultural pumping for that cell in that year. A more detailed explanation is found in Appendix B.

Estimates of aquacultural pumping were derived as follows: The location and acreage of fish ponds were obtained from the Arkansas State Water Plan (3). All of these were in Lonoke county. Extension agents in Lonoke and Prairie counties estimated about 5,000 and 7,000 acres of unreported aquaculture in the study area in those two counties, respectively. The Game and Fish Commission's

Fishery Research Station estimates 7,000 acres of aquaculture in Prairie county, and 80 acres in Arkansas county. From 1976 on, additional aquacultural acreages and water use were therefore assumed to exist in some cells in those counties where the calibration procedure showed that additional ground water withdrawals were being made.[1] These additional empirical aquacultural acreages totaled 7,698 acres. Based on information from extension agents the annual estimate of water use was 7 feet/yr. Ninety percent of the initial aquacultural water and one hundred percent of the additional aquacultural water were judged to come from the Quaternary aquifer.

Estimates of municipal pumping from the Quaternary were similarly obtained from the Arkansas State Water Plan (4).

Recharge is accomplished by: the effect of constant head cells on the study area periphery; the use of a negative pumping to represent deep percolation; and by negative pumping to reflect additional recharge in cells with significant and appropriate surface water resources. The procedures for estimating constant head cell elevations is presented in the subsequent section. Deep percolation into the Quaternary aquifer was assumed to be at least 0.03 ft/year for all parts of the study area. (This value was used by Broom and Lyford (6) in modeling a geologically similar area.) This deep percolation value was increased in cells with surface water resources. The amount of increase was estimated in the following way. The water levels in the Spring of each year of the calibration period were analyzed. The amount of recharge which would be needed to maintain those levels under steady state conditions were determined for each year's water levels. The average of those ten year's average recharge values was used as the annual recharge rate for the cell being examined.[2]

The pumping values which were used in the model to simulate from the Spring of 1981 to the Spring of 1982 are shown in Appendix C.

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1 Cells (I,J) in which additional aquacultural pumping was added are: (5,4), (6,4), (3,5), (4,5), (5,5), (6,5), (7,5), (3,6), (4,6), (5,6), (6,6), (5,7), (6,7), (7,7), (6,9), (10,9), and (11,9).

2 Cells with additional empirical recharge are: (18,11), (19,12), and (21,13). The recharge for those three cells was judged to be: 6.135 E7, 1.610 E7, and 2.021 E8 ft^3/yr.

Historical Quaternary Ground Water Levels

Spring ground water level observations were obtained from the USGS (8,16). A universal kriging procedure was used to obtain an estimate of the spring water levels for 1972-1982[1,2] in the center of each cell. For all except the boundary cells, the data for 1972 was used as the initial conditions for the calibration period. The peripheral (constant head) cells were treated differently. The average spring ground water level (1972-1981) was determined for each of these, as well as the standard deviation of that value. The standard deviations of ground water levels in these boundary cells are shown in Figure 2. Each of these peripheral cells was designated as a constant head cell with a constant water level equal to that cell's average spring elevation for those ten years.

Results of the Calibration and Sensitivity Analysis

The purposes of the calibration are to insure that the water levels and the volume of water in storage are simulated properly. There is opportunity for introducing considerable error in developing the estimates of pumping data and in preparing the observed values. Therefore, no difference between simulated and observed values which is less than five feet is considered significant. In constant head cells, the differences sometimes exceeded 10 feet. For those years, differences greater than 5 feet in adjacent cells are also not generally considered significant.

Simulated and observed values were compared for each year between 1972 and 1982. Figures 3 and 4 show the comparison for 1977 and 1982 (5 and 10 years of simulation respectively). Appendix D contains the comparison for the other years. The difference between simulated and observed elevations was generally less than $|5 \text{ ft}|$ in the unconfined region of the study area. Note that water levels are simulated well in most areas, indicating that the unconfined area may be larger than data indicated. The difference

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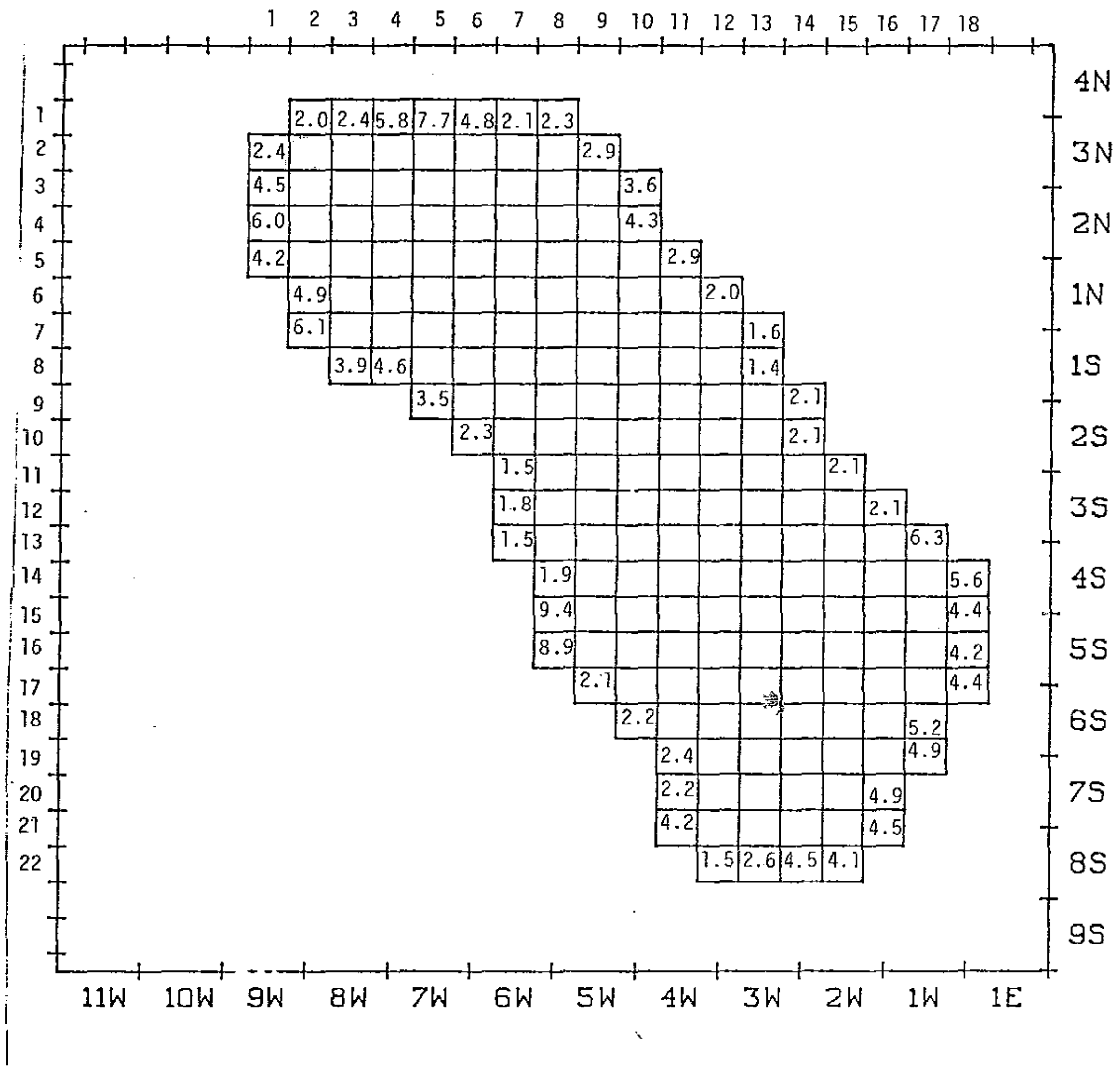
1 The 1972 elevation of well IS6W13DC (and cell I = 8, J = 8) was assumed to be erroneous since it differed so drastically from the other observed values in that location. This value was changed to reflect the trend at that location.

2 For cell I = 2, J = 5, the fitting procedure obviously gave incorrect values. Accordingly, for that cell, the polynomially gridded value for each year was replaced with a value obtained by linear interpolation. Interpolation was performed along a line between two observation wells which lay on either side of the center of that cell.

FIGURE 2

Standard Deviation of Kriged

Ground Water Levels from 1972-1981 (ft)



between simulated and observed values in constant head cells is expected. There it is generally of the same magnitude as the standard deviation of the levels in the constant head cells (Figure 2). Water levels in the center of the area are satisfactorily modeled.

Table I shows the comparison between observed and simulated estimates of the total volume of water in storage in the Quaternary aquifer underlying the unconfined part of the study area. Again the results are satisfactory. That error varied from -0.018 to 0.013 for the years 1973-1982. If the constant head cells are not included in the analysis the error is reduced further. If the entire study area is analyzed the error was .0013 and -.0044 in 1977 and 1982, respectively.

A few thoughts on calibration are appropriate here. Calibration is generally the process of adjusting assumptions (such as aquifer characteristics) in order to make one's model better simulate what actually happened. Care should be taken in this process. Otherwise, one may make the model results agree more closely with observed values without actually improving the particular assumption that was causing a problem. One may in fact be making the model less accurate in its response to other future situations. This was the governing philosophy during the calibration.

Figure 3: Simulated Minus Observed Ground Water Levels in 1977 (ft) (Using a Hydraulic Conductivity of 270 ft/day)[1]

*****	3.9	3.4	8.3	9.8	9.7	2.4	-0.3	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****
4.0	0.1	1.8	1.6	0.8	0.2	-1.4	-1.7	1.1	*****	*****	*****	*****	*****	*****	*****	*****	*****
1.9	-3.1	0.6	-2.3	-0.5	-2.5	-4.2	-3.1	-0.7	1.9	*****	*****	*****	*****	*****	*****	*****	*****
2.0	-0.5	-1.0	-5.2	-1.4	-2.4	-0.8	2.4	3.1	5.1	*****	*****	*****	*****	*****	*****	*****	*****
2.2	3.7	3.2	0.2	0.5	-0.3	1.2	4.3	5.6	2.1	2.2	*****	*****	*****	*****	*****	*****	*****
*****	3.9	1.4	3.6	3.0	2.8	5.1	5.0	2.5	2.9	1.8	1.1	*****	*****	*****	*****	*****	*****
*****	1.0	-2.3	3.8	4.2	4.0	4.8	1.5	2.9	3.4	1.5	1.1	0.4	*****	*****	*****	*****	*****
*****	*****	0.6	0.0	-0.1	1.4	-0.9	-3.5	-1.0	0.5	-0.2	-1.4	0.5	*****	*****	*****	*****	*****
*****	*****	*****	*****	-0.7	-2.1	-2.7	-0.4	0.1	-3.7	-0.2	-0.1	-2.6	0.2	*****	*****	*****	*****
*****	*****	*****	*****	*****	-1.4	-2.3	-4.1	-0.8	-5.3	-4.4	-1.6	-3.9	0.6	*****	*****	*****	*****
*****	*****	*****	*****	*****	*****	-1.1	-0.1	-0.4	-3.4	-1.3	-0.4	-2.7	-1.5	1.0	*****	*****	*****
*****	*****	*****	*****	*****	*****	-0.7	1.1	-0.2	-1.4	-0.4	0.5	-0.7	-0.7	-1.9	1.0	*****	*****
*****	*****	*****	*****	*****	*****	0.4	1.8	-1.1	-0.7	-1.1	2.4	-1.6	-0.6	-3.5	-3.5	2.6	*****
*****	*****	*****	*****	*****	*****	*****	2.1	2.0	1.2	-0.3	2.2	-0.6	0.4	-1.3	-4.4	-2.4	2.6
*****	*****	*****	*****	*****	*****	*****	3.5	-0.7	-0.3	-1.4	1.0	3.0	1.3	-0.3	-4.1	-0.4	4.5
*****	*****	*****	*****	*****	*****	*****	3.3	-3.1	-1.3	-2.5	-0.7	0.6	-1.4	-0.4	-3.6	1.2	5.8
*****	*****	*****	*****	*****	*****	*****	*****	0.0	-4.1	-7.4	-2.9	3.1	-1.6	-2.2	-1.6	3.1	6.1
*****	*****	*****	*****	*****	*****	*****	*****	*****	-1.3	-10.0	-4.7	-0.1	-0.7	-1.4	0.9	5.4	*****
*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	-0.7	-7.5	-6.0	-3.1	-2.1	2.5	5.7	*****
*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	0.3	-5.1	-6.8	-5.4	0.3	4.8	*****	*****
*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	-7.1	-9.7	-5.1	0.8	2.8	4.1	*****	*****
*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	-3.1	6.0	5.7	2.2	*****	*****	*****

SUMMATION OF DIFFERENCE (SIM-OBS) 19.20 IN FT.

[1]Values are rounded for clarity

Figure 4: Simulated Minus Observed Ground Water Levels in 1982 (ft) (Using a Hydraulic Conductivity of 270 ft/day)[1]

	5.5	8.4	1.5	-1.7	0.8	4.1	4.8										
5.6	5.7	7.8	-2.5	0.5	-7.1	2.2	0.7	4.3									
9.6	-2.1	-2.4	-1.9	0.5	-1.2	-0.9	-3.8	0.5	4.2								
10.9	0.9	-5.2	-4.7	-3.1	-2.4	-0.2	-8.7	-10.0	0.8								
9.1	6.5	0.2	-2.9	-3.2	-4.0	-2.5	-10.9	-8.0	-0.7	2.2							
	8.9	0.0	-0.2	-2.5	-3.7	-1.6	-2.9	3.4	5.5	2.7	3.0						
	6.9	0.0	4.8	0.5	2.9	-0.5	-2.9	2.4	3.1	0.6	2.9	3.2					
		8.3	9.1	2.9	3.0	2.3	-3.5	-2.6	-1.1	2.4	2.2	2.8					
				7.5	1.6	-0.9	0.1	1.2	-2.3	1.2	2.2	-1.2	2.8				
					5.1	0.0	-5.8	-3.1	-5.3	-3.0	-1.3	-3.7	3.1				
						5.4	-1.5	-3.9	-6.4	-2.6	-2.0	-4.6	-0.4	2.9			
						6.5	-1.8	-4.0	-4.6	-2.6	-1.2	-3.7	-2.0	-2.7	2.2		
						4.7	0.5	-3.2	-3.2	-1.7	3.4	-3.2	-2.4	-6.0	-4.6	0.4	
							-0.5	1.6	0.0	-1.2	2.4	-0.9	-1.4	-2.7	-3.9	-0.1	4.0
							2.4	-1.3	-2.4	-3.6	0.1	3.0	1.0	-0.6	-2.6	-3.0	2.5
							3.0	-3.3	-1.7	-3.6	-1.7	0.2	-0.8	1.7	-1.4	-1.8	2.5
								2.3	-2.1	-6.3	-3.1	2.0	-0.8	-0.9	-0.5	1.6	4.2
									-1.2	-8.9	-5.8	0.6	2.2	-0.1	1.7	5.2	
										-1.5	-11.0	-6.0	-1.6	0.3	2.8	5.3	
										2.2	-6.8	-9.0	-7.8	-1.7	3.4		
										8.0	-5.0	-3.6	-1.8	-0.4	3.8		
											4.9	2.3	3.4	3.2			

SUMMATION OF DIFFERENCE (SIM-OBS) -15.20 IN FT.

[1]Values are rounded for clarity

TABLE I

Comparison of Quaternary Storage Volume Estimated by Observed and Simulated Values (For the Unconfined Area Only)

Year	1977	1982
Simulation Period (years)	5	10
$\frac{\text{Simulated Storage} - \text{Observed Storage}}{\text{Observed Storage}}$ (Using a hydraulic conductivity of 270 ft/day)	0.0025	-0.0090
$\frac{\text{Simulated Storage} - \text{Observed Storage}}{\text{Observed Storage}}$ (Using a hydraulic conductivity of 400 ft/day)	.024	0.036

In this study the model performed adequately (particularly in the most critical area) without changing the original assumptions concerning aquifer characteristics. It predicted 1982 water levels adequately. A separate validation period is not considered necessary or appropriate.[1]

Another run was made using a hydraulic conductivity of 400 ft/day. This was performed to show the sensitivity of the model to the use of a hydraulic conductivity and transmissivities about 1.5 times those used in the original run. Appendix E contains comparisons of simulated with observed values. Table I shows how well this simulation maintained the mass balance. The simulation using 270 ft/day clearly gave the better results.

One other simulation was made using the following values for the effective porosity: 0.02 for cells which were judged to be confined throughout the study period, 0.3 for all unconfined cells, and 0.16 for cells which were both confined and unconfined during the period between 1972 and 1981. The magnitude of the effective porosity for the confining layer, 0.02, was based on the results of aquifer tests previously reported (6). Appendix F contains the difference between simulated and observed elevations in 1977 and 1982 for this run. The difference in many cells is unacceptably large for many years of simulation. This leads one to surmise that the irregularity of the top of the Quaternary aquifer may be such that confinement cannot be adequately judged using random observation points.

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[1] This model consists of two programs. The first generates linear influence coefficients which are used in the second program's simulation. These coefficients are dependent on aquifer characteristics such as transmissivity (which varies depending on the water level in an unconfined situation). Testing the model in another time period would require the use of different transmissivities and would result in the generation of different influence coefficients. Hence, little would be gained by such effort.

CONCLUSIONS AND RECOMMENDATIONS

Simulated storage volume was within .25 and -0.9 percent of observed storage in the unconfined area in 1977 and 1982, respectively. Water levels in the central portion of the study area were generally within 5 ft. of the observed values. The model simulated observed water levels quite well. It can be used to evaluate the effect of different pumping strategies on the availability of Quaternary ground water in the Grand Prairie. It can also be used to determine the pumping strategy which will maintain a sustained yield. It is recommended that the next step in this effort is to determine what ground water levels would provide a satisfactory saturated thickness for drought and litigation protection. Once a target ground water level map is developed, the appropriate sustained yield pumping strategy can also be obtained. This is the proper next step in the determination of the least cost solution to the water supply problem of the Grand Prairie.

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Appendix A

Grand Prairie Quaternary Aquifer Transmissivities

GRAND PRAIRIE QUATERNARY AQUIFER TRANSMISSIVITIES
(FT/YR X 10**6) 1

******	10.1	9.4	7.3	5.0	4.8	4.1	4.2	******	******	******	******	******	******	******	******	******	******
9.9	8.6	8.0	6.2	4.9	3.5	3.1	4.0	5.9	******	******	******	******	******	******	******	******	******
9.0	7.6	6.7	8.7	4.5	5.1	2.3	4.2	7.4	8.2	******	******	******	******	******	******	******	******
7.4	4.8	6.1	8.4	6.2	5.1	2.3	4.2	6.3	8.0	******	******	******	******	******	******	******	******
10.2	7.3	8.5	7.5	7.1	6.6	3.0	3.6	5.5	9.5	8.7	******	******	******	******	******	******	******
******	9.4	9.1	8.4	5.9	6.8	3.1	4.4	4.9	7.6	8.4	9.8	******	******	******	******	******	******
******	11.5	10.1	9.1	8.5	6.2	4.4	1.8	2.1	4.4	6.6	10.0	11.5	******	******	******	******	******
******	******	11.0	10.2	9.4	8.0	5.5	2.4	3.4	3.3	5.9	7.8	10.6	******	******	******	******	******
******	******	******	******	10.3	9.1	6.0	3.7	2.9	2.9	5.7	7.7	9.0	11.1	******	******	******	******
******	******	******	******	******	9.5	8.3	4.5	4.9	4.7	4.1	7.3	9.1	10.4	******	******	******	******
******	******	******	******	******	******	8.5	4.3	4.2	2.5	3.8	7.5	8.9	10.0	10.9	******	******	******
******	******	******	******	******	******	6.8	3.8	2.9	4.0	4.2	4.4	6.4	7.4	7.6	11.0	******	******
******	******	******	******	******	******	6.1	4.6	1.3	2.8	3.2	5.5	6.9	7.9	9.0	10.4	11.4	******
******	******	******	******	******	******	******	7.4	6.3	3.4	3.0	4.0	6.1	7.3	9.2	11.0	11.5	12.0
******	******	******	******	******	******	******	10.8	5.5	2.9	5.1	4.2	8.2	6.5	7.6	9.4	12.1	12.1
******	******	******	******	******	******	******	11.0	6.9	4.7	4.1	3.8	8.8	6.5	7.8	10.5	11.3	11.9
******	******	******	******	******	******	******	******	9.1	4.7	4.5	3.2	7.6	9.2	9.2	11.4	11.9	12.2
******	******	******	******	******	******	******	******	******	7.6	5.3	6.1	6.6	7.8	11.0	11.8	12.2	******
******	******	******	******	******	******	******	******	******	******	8.0	7.5	6.9	8.5	11.5	12.1	12.4	******
******	******	******	******	******	******	******	******	******	******	12.0	12.6	8.1	9.7	12.1	12.7	******	******
******	******	******	******	******	******	******	******	******	******	13.5	14.0	12.9	11.3	10.8	13.0	******	******
******	******	******	******	******	******	******	******	******	******	******	14.3	12.4	11.5	13.2	******	******	******

1--VALUES ARE ROUNDED FOR CLARITY.

Appendix B

Procedure to Estimate 1981 Agricultural Pumping in Cell M, County A

APPENDIX B

Procedure to Estimate 1981 Agricultural Pumping in Cell M, County A

ACRE (M) = the agricultural acreage in cell M in 1972 (ac)

TAGAC (A) = the total agricultural acreage in county A within the study area in 1972 (ac)

RAGA (A,81) = the rice acreage in county A within the study area in 1981 (ac)

SAGA (A,81) = the soybean acreage in county A within the study area in 1981 (ac)

RIR (81) = irrigation water used for rice irrigation in 1981 (ft)*

SIR (81) = irrigation water used for soybean irrigation in 1981 (ft)*

QUAT (A) = the percent of the county's irrigation water which is drawn from the Quaternary aquifer

Z (A,81) = RAGA (A,81) x RIR (81) + SAGA (A,81) x SIR (81)

= total water used for rice and soybean irrigation in county A in 1981 (ac-ft)

$$\text{AGPUMP (M,81)} = \text{Z (A,81)} \times \frac{\text{ACRE (M)}}{\text{TAGAC (A)}} \times \text{QUAT (A)}$$

= the volume of water used for rice and soybean irrigation in cell M in 1981 (ac-ft) which is pumped from the Quaternary aquifer

* The irrigation water used for rice and soybean irrigation was computed by daily water balance simulation.

Appendix C

Total Pumping from the Quaternary Aquifer in 1981

TOTAL PUMPING FROM THE QUATERNARY AQUIFER IN 1981 (AC-FT X 10**3) 1,2

******	0.0	0.0	0.0	0.0	0.0	0.0	0.0	******	******	******	******	******	******	******	******	******	******
0.0	4.3	3.8	3.1	2.9	3.8	2.0	2.3	0.0	******	******	******	******	******	******	******	******	******
0.0	6.9	4.2	3.6	7.1	6.0	2.3	2.5	0.3	0.0	******	******	******	******	******	******	******	******
0.0	8.2	3.9	6.0	6.7	6.4	2.8	2.4	1.6	0.0	******	******	******	******	******	******	******	******
0.0	6.4	3.7	6.9	7.0	6.7	4.0	1.4	2.7	2.1	0.0	******	******	******	******	******	******	******
******	0.0	7.2	7.0	7.6	6.4	3.9	2.1	7.0	2.0	0.4	0.0	******	******	******	******	******	******
******	0.0	7.8	3.6	6.7	1.6	5.2	2.8	1.0	1.1	2.7	1.2	0.0	******	******	******	******	******
******	******	0.0	0.0	4.1	2.4	1.4	2.5	2.5	2.3	1.4	1.5	0.0	******	******	******	******	******
******	******	******	******	0.0	2.7	1.7	2.3	2.1	2.3	1.9	1.8	0.9	0.0	******	******	******	******
******	******	******	******	******	0.0	1.4	2.6	3.3	1.8	2.0	2.3	1.3	0.0	******	******	******	******
******	******	******	******	******	******	0.0	2.5	2.2	2.6	1.7	2.3	2.2	1.2	0.0	******	******	******
******	******	******	******	******	******	0.0	2.6	2.6	2.5	2.7	1.7	1.6	1.9	1.8	0.0	******	******
******	******	******	******	******	******	0.0	2.2	2.2	2.2	2.6	1.7	2.2	1.7	2.6	2.0	0.0	******
******	******	******	******	******	******	******	0.0	2.3	2.6	2.1	2.0	2.1	2.1	2.3	2.5	0.9	0.0
******	******	******	******	******	******	******	0.0	1.6	2.6	2.0	1.6	1.5	1.5	2.2	2.0	1.3	0.0
******	******	******	******	******	******	******	0.0	1.4	2.2	1.8	2.7	2.8	1.9	0.3	1.1	0.6	0.0
******	******	******	******	******	******	******	******	0.0	2.7	2.1	1.8	2.8	2.4	1.8	-0.2	-0.2	0.0
******	******	******	******	******	******	******	******	******	0.0	-0.9	1.9	1.6	0.8	0.9	-0.2	0.0	******
******	******	******	******	******	******	******	******	******	******	0.0	2.2	2.6	1.4	1.9	-0.0	0.0	******
******	******	******	******	******	******	******	******	******	******	0.0	2.9	1.7	1.9	1.1	0.0	******	******
******	******	******	******	******	******	******	******	******	******	0.0	1.5	-3.8	1.0	0.9	0.0	******	******
******	******	******	******	******	******	******	******	******	******	******	0.0	0.0	0.0	0.0	******	******	******

1--VALUES ARE ROUNDED FOR CLARITY.
2--VALUES INCLUDE ALL DISCHARGES AND DEEP PERCOLATIONS.

APPENDIX D

Simulated Minus Observed Ground Water Levels

(Using a Hydraulic Conductivity of 270 ft/day)

SIMULATED-OBSERVED ELEVATIONS IN THE GRAND PRAIRIE IN THE YEAR 1973 IN FT.

*******	1.1	1.9	6.8	8.5	-0.4	-2.5	-2.5	*******	*******	*******	*******	*******	*******	*******	*******	*******	*******
-1.3	-0.5	1.0	0.8	-0.3	-2.2	-0.8	-0.8	-2.5	*******	*******	*******	*******	*******	*******	*******	*******	*******
-6.5	-5.4	-4.5	0.3	-0.5	-1.6	0.2	-0.2	-3.7	-3.0	*******	*******	*******	*******	*******	*******	*******	*******
-5.5	-1.3	-3.0	0.1	0.9	1.2	0.6	0.8	-2.3	-3.4	*******	*******	*******	*******	*******	*******	*******	*******
-4.8	1.3	2.2	2.0	0.7	0.9	1.0	1.5	-0.9	-2.2	-1.2	*******	*******	*******	*******	*******	*******	*******
*******	-4.3	1.4	1.5	0.7	0.7	1.6	1.2	-3.8	-1.4	1.3	1.2	*******	*******	*******	*******	*******	*******
*******	-5.2	-1.0	0.4	1.2	0.9	0.0	-0.3	-1.1	0.5	1.5	4.3	-0.9	*******	*******	*******	*******	*******
*******	*******	-4.7	-4.7	0.5	0.6	-5.3	-2.0	-2.0	0.3	0.4	-0.6	-0.3	*******	*******	*******	*******	*******
*******	*******	*******	*******	-0.1	1.1	-1.3	-5.1	-4.2	-0.4	1.2	0.3	-1.5	-0.4	*******	*******	*******	*******
*******	*******	*******	*******	*******	0.7	0.2	-1.3	-1.4	0.3	0.8	0.3	-1.8	0.2	*******	*******	*******	*******
*******	*******	*******	*******	*******	*******	-0.4	0.1	0.2	-0.5	0.1	0.3	-1.5	0.3	0.8	*******	*******	*******
*******	*******	*******	*******	*******	*******	-1.2	0.1	-0.8	-1.8	-0.4	-0.4	-1.0	-0.6	-0.6	0.2	*******	*******
*******	*******	*******	*******	*******	*******	-1.0	0.4	-0.7	-2.0	0.3	1.4	-1.2	0.7	3.2	0.7	-7.0	*******
*******	*******	*******	*******	*******	*******	*******	1.3	2.5	0.7	0.3	0.0	-0.1	1.7	3.6	-0.9	-4.0	-0.9
*******	*******	*******	*******	*******	*******	*******	2.4	0.3	1.0	0.0	-0.7	-0.8	0.7	1.4	1.9	2.7	2.2
*******	*******	*******	*******	*******	*******	*******	2.6	-1.6	0.2	0.2	-0.1	-1.0	-2.5	-0.8	4.7	3.6	2.8
*******	*******	*******	*******	*******	*******	*******	*******	0.9	-3.3	-3.0	-0.3	2.6	-2.3	-2.8	0.3	0.8	0.4
*******	*******	*******	*******	*******	*******	*******	*******	*******	1.6	-3.2	-4.0	1.6	-1.1	-3.8	-4.2	-1.5	*******
*******	*******	*******	*******	*******	*******	*******	*******	*******	*******	3.0	-4.0	-3.6	-1.9	-2.9	-5.6	-4.0	*******
*******	*******	*******	*******	*******	*******	*******	*******	*******	*******	2.1	-3.7	-8.1	-4.8	-5.7	-3.5	*******	*******
*******	*******	*******	*******	*******	*******	*******	*******	*******	*******	2.2	-3.6	-5.2	-4.3	-3.2	-3.2	*******	*******
*******	*******	*******	*******	*******	*******	*******	*******	*******	*******	*******	1.5	-0.5	-4.0	-2.2	*******	*******	*******

SUMMATION OF DIFFERENCE (SIM-OBS) -135.10 IN FT.

SIMULATED-OBSERVED FLEVATIONS IN THE GRAND PRARIE IN THE YEAR 1974 IN FT.

*******	-1.3	-2.8	-6.5	-8.5	-4.9	-1.9	-1.4	*******	*******	*******	*******	*******	*******	*******	*******	*******	*******
-0.5	-0.3	-0.9	-7.0	0.0	-8.1	-2.0	-0.8	-0.6	*******	*******	*******	*******	*******	*******	*******	*******	*******
-3.2	-2.9	0.1	0.6	3.3	0.9	-2.8	-1.4	-2.2	-2.4	*******	*******	*******	*******	*******	*******	*******	*******
-4.3	-1.4	-0.8	-1.2	1.6	1.1	0.9	1.6	-2.1	-2.8	*******	*******	*******	*******	*******	*******	*******	*******
-2.6	0.3	5.3	2.0	1.6	1.0	0.6	1.2	-0.9	-4.9	-4.4	*******	*******	*******	*******	*******	*******	*******
*******	-6.7	-1.3	4.8	2.7	1.2	0.1	-0.7	-2.6	-2.0	-3.2	-3.1	*******	*******	*******	*******	*******	*******
*******	-5.0	-5.4	0.0	1.5	1.7	-4.3	-0.7	-0.2	1.1	0.1	-1.2	-2.6	*******	*******	*******	*******	*******
*******	*******	-3.8	-3.9	-1.2	-0.3	-4.8	-2.5	-1.8	0.3	-0.5	-2.3	-1.9	*******	*******	*******	*******	*******
*******	*******	*******	*******	-3.4	-2.1	-2.6	1.6	0.5	-2.3	1.6	-0.3	-4.3	-2.4	*******	*******	*******	*******
*******	*******	*******	*******	*******	-2.1	-1.0	6.9	4.6	-1.1	1.9	1.4	-4.0	-2.5	*******	*******	*******	*******
*******	*******	*******	*******	*******	*******	-0.9	8.1	0.5	1.1	0.2	0.3	-2.2	-4.4	-2.0	*******	*******	*******
*******	*******	*******	*******	*******	*******	-0.1	3.5	-1.1	-1.9	-1.2	0.5	0.3	-10.6	-3.4	-1.9	*******	*******
*******	*******	*******	*******	*******	*******	-0.8	-0.5	-1.4	-3.3	-1.1	1.0	0.4	-0.1	-2.5	-4.4	-3.0	*******
*******	*******	*******	*******	*******	*******	*******	-1.4	3.3	2.2	-3.5	-1.7	-0.5	0.3	0.9	-2.2	-3.1	-3.4
*******	*******	*******	*******	*******	*******	*******	-26.6	-1.7	0.9	-4.1	0.5	1.8	1.0	0.3	-2.7	-8.2	-4.1
*******	*******	*******	*******	*******	*******	*******	-25.1	-5.2	1.8	-1.6	-0.5	0.2	-1.0	-1.0	-5.0	-8.7	-4.8
*******	*******	*******	*******	*******	*******	*******	*******	-2.5	2.2	2.7	0.8	2.4	-2.0	-5.7	-9.3	-8.8	-5.6
*******	*******	*******	*******	*******	*******	*******	*******	*******	2.6	0.2	0.7	2.6	-2.3	-8.6	-10.4	-6.8	*******
*******	*******	*******	*******	*******	*******	*******	*******	*******	*******	2.3	-4.1	-2.2	-5.6	-8.3	-9.7	-6.6	*******
*******	*******	*******	*******	*******	*******	*******	*******	*******	*******	1.8	-2.9	-8.2	-10.6	-9.9	-6.4	*******	*******
*******	*******	*******	*******	*******	*******	*******	*******	*******	*******	3.4	2.5	-5.5	-6.5	-5.8	-4.5	*******	*******
*******	*******	*******	*******	*******	*******	*******	*******	*******	*******	*******	-0.3	-1.0	-1.9	-3.2	*******	*******	*******

SUMMATION OF DIFFERENCE (SIM-OBS) -398.60 IN FT.

SIMULATED-OBSERVED ELEVATIONS IN THE GRAND PRARIE IN THE YEAR 1975 IN FT.

*******	-2.9	-3.6	-7.7	-9.8	-6.4	-2.8	-2.4	*******	*******	*******	*******	*******	*******	*******	*******	*******	*******
-1.8	-1.1	-0.8	-7.6	0.5	-8.2	-1.5	-2.2	-5.3	*******	*******	*******	*******	*******	*******	*******	*******	*******
-2.7	-3.1	1.5	-0.4	0.5	-0.3	-2.9	-3.1	-4.4	-5.8	*******	*******	*******	*******	*******	*******	*******	*******
-2.5	-1.4	-0.7	-4.8	0.4	0.0	1.2	1.8	-1.4	-5.3	*******	*******	*******	*******	*******	*******	*******	*******
-1.5	1.4	1.0	-1.9	0.4	0.8	1.5	4.6	0.7	-3.8	-3.6	*******	*******	*******	*******	*******	*******	*******
*******	-0.6	-1.4	0.9	1.1	1.6	-1.0	2.7	-0.8	-2.2	-2.1	-3.0	*******	*******	*******	*******	*******	*******
*******	-3.1	-4.3	1.6	2.2	0.6	-3.8	-1.9	1.2	1.4	0.0	-1.5	-2.4	*******	*******	*******	*******	*******
*******	*******	-1.6	-2.2	-1.2	-0.2	-3.7	-4.3	-1.9	0.3	2.5	0.2	-2.4	*******	*******	*******	*******	*******
*******	*******	*******	*******	-3.0	-2.3	-1.9	0.3	0.0	-3.1	1.7	2.5	-3.9	-3.3	*******	*******	*******	*******
*******	*******	*******	*******	*******	-1.9	-0.6	-1.5	0.2	-4.6	-2.2	-0.5	-5.8	-3.6	*******	*******	*******	*******
*******	*******	*******	*******	*******	*******	-1.0	1.7	0.1	-2.4	-0.3	-2.0	-7.9	-6.1	-3.7	*******	*******	*******
*******	*******	*******	*******	*******	*******	-1.5	2.9	0.3	-1.3	-0.5	-3.6	-8.0	-3.0	-4.7	-4.0	*******	*******
*******	*******	*******	*******	*******	*******	-0.7	2.5	-1.4	-1.1	-2.1	-0.5	-4.4	-1.3	-4.9	-7.9	-6.5	*******
*******	*******	*******	*******	*******	*******	*******	1.5	0.6	-0.6	-1.5	0.5	-1.1	-0.4	-1.1	-5.1	-11.6	-7.2
*******	*******	*******	*******	*******	*******	*******	3.0	-1.6	-0.9	-1.5	0.2	1.8	0.6	-0.7	-4.4	-9.1	-5.2
*******	*******	*******	*******	*******	*******	*******	1.6	-4.1	-1.9	-2.2	-0.9	0.3	-1.8	-2.0	-6.6	-8.5	-4.3
*******	*******	*******	*******	*******	*******	*******	*******	-2.6	-5.9	-7.9	-2.9	2.2	-2.7	-7.5	-11.1	-8.7	-5.7
*******	*******	*******	*******	*******	*******	*******	*******	*******	-1.4	-10.8	-3.9	0.0	-3.7	-10.5	-12.4	-8.4	*******
*******	*******	*******	*******	*******	*******	*******	*******	*******	*******	0.1	-5.2	-5.8	-8.4	-11.0	-9.3	-4.9	*******
*******	*******	*******	*******	*******	*******	*******	*******	*******	*******	1.8	-3.8	-7.6	-8.9	-6.7	-3.1	*******	*******
*******	*******	*******	*******	*******	*******	*******	*******	*******	*******	2.8	-7.4	-7.0	-6.6	-3.5	-2.5	*******	*******
*******	*******	*******	*******	*******	*******	*******	*******	*******	*******	*******	-2.0	-4.4	-7.8	-2.1	*******	*******	*******

SUMMATION OF DIFFERENCE (SIM-OBS) -524.79 IN FT.

SIMULATED-OBSERVED ELEVATIONS IN THE GRAND PRARIE IN THE YEAR 1976 IN FT.

*******	-1.5	-2.3	3.8	8.6	6.1	0.3	-1.6	*******	*******	*******	*******	*******	*******	*******	*******	*******	*******
0.7	-2.6	-0.3	3.3	1.7	2.8	-0.3	-2.4	-0.5	*******	*******	*******	*******	*******	*******	*******	*******	*******
-1.1	-4.2	1.2	1.6	4.0	1.4	-2.8	-3.3	-1.8	0.4	*******	*******	*******	*******	*******	*******	*******	*******
-4.4	-8.7	-1.2	-1.7	2.5	2.2	1.0	1.0	1.8	0.5	*******	*******	*******	*******	*******	*******	*******	*******
-1.3	-6.5	2.0	0.9	2.2	4.9	1.5	3.1	4.0	0.4	0.3	*******	*******	*******	*******	*******	*******	*******
*******	-1.9	-0.3	2.4	3.6	6.3	-0.5	0.9	4.4	1.4	0.2	-0.4	*******	*******	*******	*******	*******	*******
*******	-2.9	-2.9	2.8	3.9	3.1	-3.1	-4.2	2.2	3.1	0.0	-0.1	0.2	*******	*******	*******	*******	*******
*******	*******	0.0	0.7	0.3	0.5	-4.7	-5.2	-3.6	3.5	3.8	1.0	0.4	*******	*******	*******	*******	*******
*******	*******	*******	*******	-1.7	-2.6	-3.2	-7.2	-6.5	-4.3	2.1	2.9	-1.2	0.4	*******	*******	*******	*******
*******	*******	*******	*******	*******	-1.7	-1.1	-4.3	-4.3	-5.7	-2.2	0.3	-3.0	0.0	*******	*******	*******	*******
*******	*******	*******	*******	*******	*******	0.0	1.7	-0.1	-3.1	-0.7	-0.7	-4.5	-3.1	-1.2	*******	*******	*******
*******	*******	*******	*******	*******	*******	0.7	4.5	0.7	-0.9	-0.1	-1.2	-4.3	-3.1	-3.7	-1.4	*******	*******
*******	*******	*******	*******	*******	*******	0.0	4.7	-1.2	-0.2	-0.5	2.0	-2.2	-1.0	-4.4	-4.4	0.6	*******
*******	*******	*******	*******	*******	*******	*******	-2.6	1.0	1.0	-0.2	1.7	0.8	1.5	-0.1	-4.5	-5.0	-0.9
*******	*******	*******	*******	*******	*******	*******	3.3	-1.0	-0.3	-1.6	0.1	1.9	1.8	0.1	-4.2	-4.0	-0.7
*******	*******	*******	*******	*******	*******	*******	3.1	-3.0	-1.4	-2.2	-0.7	-0.1	-2.4	-1.5	-3.7	-3.8	-0.9
*******	*******	*******	*******	*******	*******	*******	*******	-0.6	-4.7	-7.6	-2.8	2.5	-2.6	-4.1	-4.4	-3.2	-2.2
*******	*******	*******	*******	*******	*******	*******	*******	*******	-1.3	-10.7	-5.2	-0.9	-2.3	-4.3	-3.8	-1.4	*******
*******	*******	*******	*******	*******	*******	*******	*******	*******	*******	-1.6	-8.1	-7.2	-5.7	-5.3	-3.1	-2.2	*******
*******	*******	*******	*******	*******	*******	*******	*******	*******	*******	0.1	-5.6	-8.8	-8.6	-3.5	-1.4	*******	*******
*******	*******	*******	*******	*******	*******	*******	*******	*******	*******	2.6	-7.1	-5.4	-2.5	-1.7	-1.0	*******	*******
*******	*******	*******	*******	*******	*******	*******	*******	*******	*******	*******	-0.3	-0.8	1.5	0.0	*******	*******	*******

SUMMATION OF DIFFERENCE (SIM-OBS) -203.60 IN FT.

SIMULATED-OBSERVED ELEVATIONS IN THE GRAND PRARIE IN THE YEAR 1977 IN FT.

*******	3.9	3.4	8.3	9.8	9.7	2.4	-0.3	*******	*******	*******	*******	*******	*******	*******	*******	*******	*******
4.0	0.1	1.8	1.6	0.8	0.2	-1.4	-1.7	1.1	*******	*******	*******	*******	*******	*******	*******	*******	*******
1.9	-3.1	0.6	-2.3	-0.5	-2.5	-4.2	-3.1	-0.7	1.9	*******	*******	*******	*******	*******	*******	*******	*******
2.0	-0.5	-1.0	-5.2	-1.4	-2.4	-0.8	2.4	3.1	5.1	*******	*******	*******	*******	*******	*******	*******	*******
2.2	3.7	3.2	0.2	0.5	-0.3	1.2	4.3	5.6	2.1	2.2	*******	*******	*******	*******	*******	*******	*******
*******	3.9	1.4	3.6	3.0	2.8	5.1	5.0	2.5	2.9	1.8	1.1	*******	*******	*******	*******	*******	*******
*******	1.0	-2.3	3.8	4.2	4.0	4.8	1.5	2.9	3.4	1.5	1.1	0.4	*******	*******	*******	*******	*******
*******	*******	0.6	0.0	-0.1	1.4	-0.9	-3.5	-1.0	0.5	-0.2	-1.4	0.5	*******	*******	*******	*******	*******
*******	*******	*******	*******	-0.7	-2.1	-2.7	-0.4	0.1	-3.7	-0.2	-0.1	-2.6	0.2	*******	*******	*******	*******
*******	*******	*******	*******	*******	-1.4	-2.3	-4.1	-0.8	-5.3	-4.4	-1.6	-3.9	0.6	*******	*******	*******	*******
*******	*******	*******	*******	*******	*******	-1.1	-0.1	-0.4	-3.4	-1.3	-0.4	-2.7	-1.5	1.0	*******	*******	*******
*******	*******	*******	*******	*******	*******	-0.7	1.1	-0.2	-1.4	-0.4	0.5	-0.7	-0.7	-1.9	1.0	*******	*******
*******	*******	*******	*******	*******	*******	0.4	1.8	-1.1	-0.7	-1.1	2.4	-1.6	-0.6	-3.5	-3.5	2.6	*******
*******	*******	*******	*******	*******	*******	*******	2.1	2.0	1.2	-0.3	2.2	-0.6	0.4	-1.3	-4.4	-2.4	2.6
*******	*******	*******	*******	*******	*******	*******	3.5	-0.7	-0.3	-1.4	1.0	3.0	1.3	-0.3	-4.1	-0.4	4.5
*******	*******	*******	*******	*******	*******	*******	3.3	-3.1	-1.3	-2.5	-0.7	0.6	-1.4	-0.4	-3.6	1.2	5.8
*******	*******	*******	*******	*******	*******	*******	*******	0.0	-4.1	-7.4	-2.9	3.1	-1.6	-2.2	-1.6	3.1	6.1
*******	*******	*******	*******	*******	*******	*******	*******	*******	-1.3	-10.0	-4.7	-0.1	-0.7	-1.4	0.9	5.4	*******
*******	*******	*******	*******	*******	*******	*******	*******	*******	*******	-0.7	-7.5	-6.0	-3.1	-2.1	2.5	5.7	*******
*******	*******	*******	*******	*******	*******	*******	*******	*******	*******	0.3	-5.1	-6.8	-5.4	0.3	4.8	*******	*******
*******	*******	*******	*******	*******	*******	*******	*******	*******	*******	-7.1	-9.7	-5.1	0.8	2.8	4.1	*******	*******
*******	*******	*******	*******	*******	*******	*******	*******	*******	*******	*******	-3.1	6.0	5.7	2.2	*******	*******	*******

SUMMATION OF DIFFERENCE (SIM-OBS) 19.20 IN FT.

SIMULATED-OBSERVED ELEVATIONS IN THE GRAND PRARIE IN THE YEAR 1978 IN FT.

	0.2	0.4	-1.3	-3.4	0.0	1.3	0.6										
4.3	0.8	1.4	-3.5	2.1	-5.0	0.0	-1.6	-0.7									
3.8	-2.3	1.6	0.0	4.4	1.1	-2.8	-4.5	-2.5	-0.3								
4.6	1.3	-1.2	-0.9	5.0	4.0	1.7	2.4	2.4	-0.4								
3.8	5.7	1.3	3.1	5.1	3.4	1.1	6.2	5.4	0.3	0.4							
	3.7	0.8	3.8	3.5	1.4	-1.2	2.5	1.8	2.1	0.8	0.3						
	7.8	3.3	3.5	3.1	3.0	-2.5	-1.3	2.3	3.3	1.5	0.9	1.1					
		2.3	1.2	1.5	2.9	1.7	-1.8	-0.6	1.0	2.8	1.4	1.1					
				1.3	-0.5	-1.6	0.9	1.2	-1.7	2.4	3.2	-0.9	1.2				
					0.3	-1.6	-3.6	1.0	-2.2	-1.1	0.5	-2.5	0.9				
						-0.1	0.9	2.2	-1.4	-1.1	-0.1	-1.7	-2.7	0.8			
						0.2	1.4	1.7	0.6	-0.1	0.9	-0.1	-1.9	-1.3	1.4		
						0.6	1.6	-0.5	0.1	-0.1	3.3	-1.8	-2.0	-3.0	-3.8	-0.7	
							1.6	2.3	1.5	0.0	2.5	-1.0	-0.9	-1.9	-4.5	-0.6	3.4
							2.7	0.1	-0.3	-1.5	1.1	3.1	0.6	-0.9	-3.1	1.8	4.0
							2.4	-2.3	-1.2	-2.1	0.1	1.4	-1.0	-0.2	-1.9	2.6	4.4
								0.2	-4.6	-7.3	-1.8	3.2	-0.4	-1.5	-0.5	3.3	4.1
									-1.3	-9.1	-3.9	-0.6	0.4	-0.6	0.7	3.6	
										-1.5	-7.5	-6.7	-2.1	-0.3	1.5	3.1	
										0.5	-5.8	-7.5	-4.8	0.7	3.5		
										3.3	-6.8	-3.8	0.4	1.5	3.5		
											1.0	1.4	4.7	4.4			

SUMMATION OF DIFFERENCE (SIM-OBS) 78.00 IN FT.

SIMULATED-OBSERVED ELEVATIONS IN THE GRAND PRARIE IN THE YEAR 1979 IN FT.

*******	-2.0	-0.8	-4.4	-4.7	-1.8	1.2	1.7	*******	*******	*******	*******	*******	*******	*******	*******	*******	*******
-2.6	-1.3	1.2	-5.0	-0.3	-7.8	-0.7	-1.0	-0.7	*******	*******	*******	*******	*******	*******	*******	*******	*******
3.3	-1.5	1.5	-1.8	-0.7	-3.0	-3.4	-3.8	-1.4	-1.2	*******	*******	*******	*******	*******	*******	*******	*******
6.8	0.8	-2.0	-3.8	-0.3	-0.4	0.3	0.3	-0.2	-1.6	*******	*******	*******	*******	*******	*******	*******	*******
3.7	4.4	-0.1	-0.5	1.0	0.6	-0.3	3.3	2.2	-1.0	-0.5	*******	*******	*******	*******	*******	*******	*******
*******	4.8	0.6	2.3	1.6	0.7	-2.2	2.7	0.4	2.0	0.9	0.3	*******	*******	*******	*******	*******	*******
*******	11.1	5.6	4.1	2.2	2.8	-4.0	-1.4	1.8	2.7	1.1	1.5	0.6	*******	*******	*******	*******	*******
*******	*******	4.6	2.7	1.6	2.6	0.8	-3.8	-2.0	-0.6	2.3	1.2	-0.1	*******	*******	*******	*******	*******
*******	*******	*******	*******	2.5	-0.3	-1.5	1.0	2.6	-1.8	1.1	1.5	-3.2	-0.6	*******	*******	*******	*******
*******	*******	*******	*******	*******	1.4	-1.0	-4.6	-0.6	-4.1	-3.0	-1.5	-5.0	-0.7	*******	*******	*******	*******
*******	*******	*******	*******	*******	*******	2.9	-1.5	-2.6	-5.0	-2.1	-0.9	-2.9	-3.5	0.0	*******	*******	*******
*******	*******	*******	*******	*******	*******	3.8	-1.5	-2.9	-2.7	-0.5	1.6	0.2	-1.7	-1.8	-0.3	*******	*******
*******	*******	*******	*******	*******	*******	2.5	-0.2	-3.2	-1.4	0.5	4.8	-2.0	-1.9	-3.4	-6.0	-4.5	*******
*******	*******	*******	*******	*******	*******	*******	-1.3	0.9	1.3	0.4	3.1	-1.5	-0.7	-1.3	-4.0	-9.8	-5.6
*******	*******	*******	*******	*******	*******	*******	2.5	-0.7	-0.8	-2.2	0.6	3.0	1.3	-0.1	-4.1	-7.1	-3.3
*******	*******	*******	*******	*******	*******	*******	2.4	-2.6	-1.2	-2.5	-0.4	1.0	-0.5	0.1	-6.7	-5.4	-1.8
*******	*******	*******	*******	*******	*******	*******	*******	0.1	-4.0	-6.9	-2.1	2.8	-0.6	-3.7	-6.6	-3.9	-2.1
*******	*******	*******	*******	*******	*******	*******	*******	*******	-1.3	-8.9	-4.1	-0.2	0.5	-4.8	-5.6	-2.8	*******
*******	*******	*******	*******	*******	*******	*******	*******	*******	*******	-1.9	-8.1	-7.1	-3.2	-3.6	-5.2	-3.4	*******
*******	*******	*******	*******	*******	*******	*******	*******	*******	*******	0.2	-7.5	-9.6	-8.2	-8.1	-5.0	*******	*******
*******	*******	*******	*******	*******	*******	*******	*******	*******	*******	2.7	-7.7	-5.9	-6.5	-7.3	-4.7	*******	*******
*******	*******	*******	*******	*******	*******	*******	*******	*******	*******	*******	0.6	-0.9	-2.5	-4.0	*******	*******	*******

SUMMATION OF DIFFERENCE (SIM-OBS) -238.90 IN FT.

SIMULATED-OBSERVED ELEVATIONS IN THE GRAND PRAIRIE IN THE YEAR 1980 IN FT.

*******	-0.5	0.2	-4.0	-4.8	-1.9	1.7	2.9	*******	*******	*******	*******	*******	*******	*******	*******	*******	*******
-0.5	-1.1	0.9	-5.5	1.9	-8.8	-0.9	0.0	2.7	*******	*******	*******	*******	*******	*******	*******	*******	*******
5.1	-7.4	-8.9	0.0	-2.8	-6.0	-4.4	-3.0	2.2	4.5	*******	*******	*******	*******	*******	*******	*******	*******
1.3	-8.7	-8.9	-1.8	-1.4	-2.2	-0.4	1.1	4.8	5.1	*******	*******	*******	*******	*******	*******	*******	*******
1.7	-5.6	1.1	0.4	-1.0	-0.9	-2.6	2.1	4.3	1.2	0.8	*******	*******	*******	*******	*******	*******	*******
*******	2.9	0.4	0.4	-0.6	-0.7	-5.4	-0.3	-0.4	2.0	0.6	-0.3	*******	*******	*******	*******	*******	*******
*******	1.2	-1.7	2.7	0.0	1.8	-4.5	-1.9	2.7	2.5	-0.3	-0.5	-0.1	*******	*******	*******	*******	*******
*******	*******	3.3	3.9	0.1	1.3	3.0	-0.2	-0.7	-0.3	0.6	-0.8	-0.6	*******	*******	*******	*******	*******
*******	*******	*******	*******	2.2	-0.8	-1.2	1.1	0.6	-3.2	0.0	0.2	-3.5	-0.9	*******	*******	*******	*******
*******	*******	*******	*******	*******	1.2	-1.4	-5.3	-1.9	-4.7	-3.7	-2.0	-5.3	-0.9	*******	*******	*******	*******
*******	*******	*******	*******	*******	*******	-0.1	-2.8	-2.1	-4.2	-1.3	-0.6	-3.7	-4.5	-1.1	*******	*******	*******
*******	*******	*******	*******	*******	*******	-1.6	-4.3	-2.5	-2.5	-0.5	1.2	-1.2	-3.9	-4.1	-0.7	*******	*******
*******	*******	*******	*******	*******	*******	-2.8	-3.4	-3.0	-2.0	-0.7	3.9	-2.3	-3.5	-5.9	-6.1	-2.4	*******
*******	*******	*******	*******	*******	*******	*******	-2.9	1.1	0.5	-0.6	2.6	-0.8	-1.8	-2.8	-5.0	-9.8	-4.9
*******	*******	*******	*******	*******	*******	*******	1.3	-2.3	-2.1	-3.0	0.3	3.1	0.8	-1.0	-5.4	-10.7	-6.2
*******	*******	*******	*******	*******	*******	*******	1.5	-5.5	-4.9	-4.8	-2.4	0.3	-0.6	0.1	-8.0	-9.8	-6.2
*******	*******	*******	*******	*******	*******	*******	*******	-1.5	-9.6	-11.5	-4.1	2.2	-1.5	-3.3	-7.0	-5.9	-3.4
*******	*******	*******	*******	*******	*******	*******	*******	*******	-2.3	-9.5	-5.4	-1.1	-1.6	-4.1	-3.6	-0.6	*******
*******	*******	*******	*******	*******	*******	*******	*******	*******	*******	-3.2	-9.2	-9.2	-6.5	-5.6	-1.9	0.3	*******
*******	*******	*******	*******	*******	*******	*******	*******	*******	*******	-2.0	-9.5	-11.6	-10.2	-4.2	-0.2	*******	*******
*******	*******	*******	*******	*******	*******	*******	*******	*******	*******	0.7	-9.4	-6.3	-3.2	-2.1	0.6	*******	*******
*******	*******	*******	*******	*******	*******	*******	*******	*******	*******	*******	-0.3	-0.3	1.7	0.8	*******	*******	*******

SUMMATION OF DIFFERENCE (SIM-OBS) -389.70 IN FT.

SIMULATED-OBSERVED ELEVATIONS IN THE GRAND PRARIE IN THE YEAR 1981 IN FT.

	0.8	2.9	-1.3	-3.3	-1.1	2.3	4.1										
-2.2	-1.3	2.2	-4.5	1.5	-7.2	1.4	0.9	5.3									
5.5	-1.7	0.5	1.5	1.0	-1.5	-1.0	-3.0	-0.5	-1.2								
10.5	1.9	-2.1	-2.0	-1.9	-1.6	1.0	-5.1	-9.0	-4.4								
6.0	6.2	0.8	-1.4	-0.5	-2.6	-0.5	-0.1	-3.6	3.5	5.9							
	6.0	-0.2	4.1	2.6	-1.7	-0.5	2.7	2.6	5.6	4.6	3.7						
	3.7	-1.3	8.6	7.3	7.8	-0.5	-1.2	2.5	2.5	0.1	2.1	2.8					
		5.4	8.9	7.6	9.0	6.1	-1.7	-1.8	-0.7	2.1	1.4	2.3					
				7.4	3.9	1.2	1.0	2.2	-0.6	2.0	1.5	-1.0	2.1				
					5.0	0.5	-3.3	-1.0	-1.8	-0.7	0.5	-3.0	2.9				
						2.2	0.6	-6.2	-10.1	-2.4	3.2	-2.6	-0.1	2.7			
						2.3	-2.8	-13.2	-13.7	-6.9	0.6	-1.0	-1.2	-1.8	2.8		
						1.6	-0.2	-8.6	-9.2	-1.9	3.9	-1.9	-1.6	-4.1	-1.0	8.4	
							0.2	1.8	-0.2	0.5	3.8	-0.3	-0.6	-2.6	-4.0	2.8	8.5
							3.8	0.2	-0.4	-0.3	3.5	5.2	1.7	-0.7	-3.6	1.0	4.9
							3.6	-3.1	-0.2	3.1	8.5	5.1	-0.2	1.1	-1.8	1.1	3.7
								1.4	-3.8	-2.8	7.7	6.6	-0.2	-0.2	1.3	3.8	4.9
									-0.3	-6.1	0.5	-0.1	1.6	1.9	4.7	7.2	
										-0.9	-9.5	-5.8	-1.5	0.2	6.4	7.5	
										0.4	-7.7	-8.3	-4.8	5.1	9.2		
										-4.4	-8.8	-3.6	4.3	7.4	9.4		
											1.2	0.1	5.2	8.6			

SUMMATION OF DIFFERENCE (SIM-OBS) 144.30 IN FT.

SIMULATED-OBSERVED ELEVATIONS IN THE GRAND PRARIE IN THE YEAR 1982 IN FT.

*******	5.5	8.4	1.5	-1.7	0.8	4.1	4.8	*******	*******	*******	*******	*******	*******	*******	*******	*******	*******
5.6	5.7	7.8	-2.5	0.5	-7.1	2.2	0.7	4.3	*******	*******	*******	*******	*******	*******	*******	*******	*******
9.6	-2.1	-2.4	-1.9	0.5	-1.2	-0.9	-3.8	0.5	4.2	*******	*******	*******	*******	*******	*******	*******	*******
10.9	0.9	-5.2	-4.7	-3.1	-2.4	-0.2	-8.7	-10.0	0.8	*******	*******	*******	*******	*******	*******	*******	*******
9.1	6.5	0.2	-2.9	-3.2	-4.0	-2.5	-10.9	-8.0	-0.7	2.2	*******	*******	*******	*******	*******	*******	*******
*******	8.8	0.0	-0.2	-2.5	-3.7	-1.6	-2.9	3.4	5.5	2.7	3.0	*******	*******	*******	*******	*******	*******
*******	6.9	0.0	4.8	0.5	2.9	-0.5	-2.9	2.4	3.1	0.6	2.9	3.2	*******	*******	*******	*******	*******
*******	*******	8.3	9.1	2.9	3.0	2.3	-3.5	-2.6	-1.1	2.4	2.2	2.8	*******	*******	*******	*******	*******
*******	*******	*******	*******	7.5	1.6	-0.9	0.1	1.2	-2.3	1.2	2.2	-1.2	2.8	*******	*******	*******	*******
*******	*******	*******	*******	*******	5.1	0.0	-5.8	-3.1	-5.3	-3.0	-1.3	-3.7	3.1	*******	*******	*******	*******
*******	*******	*******	*******	*******	*******	5.4	-1.5	-3.9	-6.4	-2.6	-2.0	-4.6	-0.4	2.9	*******	*******	*******
*******	*******	*******	*******	*******	*******	6.5	-1.8	-4.0	-4.6	-2.6	-1.2	-3.7	-2.0	-2.7	2.2	*******	*******
*******	*******	*******	*******	*******	*******	4.7	0.5	-3.2	-3.2	-1.7	3.4	-3.2	-2.4	-6.0	-4.6	0.4	*******
*******	*******	*******	*******	*******	*******	*******	-0.5	1.6	0.0	-1.2	2.4	-0.9	-1.4	-2.7	-3.9	-0.1	4.0
*******	*******	*******	*******	*******	*******	*******	2.4	-1.3	-2.4	-3.6	0.1	3.0	1.0	-0.6	-2.6	-3.0	2.5
*******	*******	*******	*******	*******	*******	*******	3.0	-3.3	-1.7	-3.6	-1.7	0.2	-0.8	1.7	-1.4	-1.8	2.5
*******	*******	*******	*******	*******	*******	*******	*******	2.3	-2.1	-6.3	-3.1	2.0	-0.8	-0.9	-0.5	1.6	4.2
*******	*******	*******	*******	*******	*******	*******	*******	*******	-1.2	-8.9	-5.8	0.6	2.2	-0.1	1.7	5.2	*******
*******	*******	*******	*******	*******	*******	*******	*******	*******	*******	-1.5	-11.0	-6.0	-1.6	0.3	2.8	5.3	*******
*******	*******	*******	*******	*******	*******	*******	*******	*******	*******	2.2	-6.8	-9.0	-7.8	-1.7	3.4	*******	*******
*******	*******	*******	*******	*******	*******	*******	*******	*******	*******	8.0	-5.0	-3.6	-1.8	-0.4	3.8	*******	*******
*******	*******	*******	*******	*******	*******	*******	*******	*******	*******	*******	4.9	2.3	3.4	3.2	*******	*******	*******

SUMMATION OF DIFFERENCE (SIM-OBS) -15.20 IN FT.

APPENDIX E

Simulated Minus Observed Ground Water Levels

(Using a Hydraulic Conductivity of 400 ft/day)

SIMULATED-OBSERVED ELEVATIONS IN THE GRAND PRARIE IN THE YEAR 1977 IN FT.

*******	3.9	3.4	8.3	9.8	9.7	2.4	-0.3	*******	*******	*******	*******	*******	*******	*******	*******	*******
4.0	3.0	4.1	2.5	1.7	1.8	-0.5	-1.4	1.1	*******	*******	*******	*******	*******	*******	*******	*******
1.9	1.8	2.3	-1.1	1.1	-1.1	-3.5	-3.1	-0.4	1.9	*******	*******	*******	*******	*******	*******	*******
2.0	3.6	0.3	-3.3	0.0	-1.1	0.1	3.8	4.7	5.1	*******	*******	*******	*******	*******	*******	*******
2.2	6.9	4.7	1.4	1.5	0.7	1.9	5.7	7.8	3.5	2.2	*******	*******	*******	*******	*******	*******
*******	3.9	3.7	4.6	3.9	3.7	5.5	5.9	4.1	4.4	2.7	1.1	*******	*******	*******	*******	*******
*******	1.0	-0.1	4.7	4.8	4.4	5.9	2.6	4.0	4.8	3.1	2.2	0.4	*******	*******	*******	*******
*******	*******	0.6	0.0	0.4	1.9	0.6	-2.5	0.8	2.1	0.6	-0.8	0.5	*******	*******	*******	*******
*******	*******	*******	*******	-0.7	-1.7	-2.0	0.8	2.1	-1.6	1.1	0.6	-2.1	0.2	*******	*******	*******
*******	*******	*******	*******	*******	-1.4	-1.7	-3.3	1.1	-3.5	-3.0	-0.7	-3.2	0.6	*******	*******	*******
*******	*******	*******	*******	*******	*******	-1.1	1.2	1.5	-2.1	-0.2	0.8	-1.9	-0.9	1.0	*******	*******
*******	*******	*******	*******	*******	*******	-0.7	2.7	1.4	-0.4	0.7	1.5	0.0	-0.1	-1.2	1.0	*******
*******	*******	*******	*******	*******	*******	0.4	3.9	0.5	0.4	0.2	3.8	-0.6	0.1	-2.6	-2.6	2.6
*******	*******	*******	*******	*******	*******	*******	2.1	5.5	4.1	1.3	3.7	0.9	1.6	-0.2	-3.3	-1.7
*******	*******	*******	*******	*******	*******	*******	3.5	2.7	3.5	0.3	2.4	4.7	2.8	1.2	-3.2	0.4
*******	*******	*******	*******	*******	*******	*******	3.3	0.1	4.1	0.1	1.3	2.9	0.7	0.9	-3.0	1.8
*******	*******	*******	*******	*******	*******	*******	*******	0.0	2.0	-2.5	-0.2	5.6	0.7	-0.4	-0.9	3.4
*******	*******	*******	*******	*******	*******	*******	*******	*******	-1.3	-6.0	-0.1	2.5	1.3	0.2	1.7	3.4
*******	*******	*******	*******	*******	*******	*******	*******	*******	*******	-0.7	-2.4	-2.1	-0.6	-0.4	3.3	5.7
*******	*******	*******	*******	*******	*******	*******	*******	*******	*******	0.3	-2.7	-4.7	-4.0	1.3	4.8	*******
*******	*******	*******	*******	*******	*******	*******	*******	*******	*******	-7.1	-9.4	-7.3	0.5	3.1	4.1	*******
*******	*******	*******	*******	*******	*******	*******	*******	*******	*******	*******	-3.1	6.0	5.7	2.2	*******	*******

SUMMATION OF DIFFERENCE (SIM-OBS) 250.80 IN FT.

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DIFFERENCE (SIMULATED-OBSERVED) SAT. ELEV. IN     THE YEAR  1977     IN FT.

******   0.0   0.0   8.3   0.0   0.0   0.0  -0.3************************************************************
   0.0   0.0   1.5   2.5   0.0   1.8  -0.5  -1.4   1.1******************************************************
   0.0   0.0   2.3  -1.1   1.1  -1.1  -3.5  -3.1  -0.4   1.9************************************************
   2.0   3.6   0.3  -3.3   0.0  -1.1   0.1   3.8   4.7   1.3************************************************
   2.2   6.9   4.7   1.4   1.5   0.7   1.9   5.7   7.8   3.5   0.0******************************************
******   3.9   3.7   4.6   3.9   3.7   5.5   5.9   4.1   4.4   0.0   0.0************************************
******   1.0  -0.1   4.7   4.6   4.4   5.9   2.6   4.0   4.8   0.0   0.0   0.0******************************
************   0.6   0.0   0.4   1.9   0.6  -2.5   0.8   2.1   0.6  -0.8   0.5******************************
************************  -0.7  -1.7  -2.0   0.8   2.1  -1.5   1.1   0.6   0.0   0.0************************
******************************   0.0   0.0  -3.3   1.1  -3.5  -3.0  -0.7  -3.2   0.0************************
************************************   0.0   0.0   1.5  -2.1  -0.2   0.8  -1.9   0.0   0.0******************
************************************   0.0   0.0   1.4  -0.4   0.7   1.5   0.0  -0.1   0.0   0.0************
************************************   0.0   0.0   0.5   0.4   0.2   3.8  -0.6   0.0  -0.2   0.0   0.0******
******************************************   0.0   4.9   4.1   1.3   3.7   0.9   1.5  -0.2   0.0   0.0   0.0
******************************************   0.0   0.0   0.0   0.3   2.4   4.7   2.6   0.0   0.0   0.0   0.0
******************************************   0.0   0.0   0.0   0.1   1.3   2.9   0.0   0.0   0.0   0.0   0.0
************************************************   0.0   0.0  -2.5  -0.2   5.6   0.7   0.0   0.0   0.0   0.0
******************************************************   0.0   0.0   0.0   2.5   1.3   0.0   0.0   0.0******
************************************************************   0.0   0.0   0.0   0.0   0.0   0.0   0.0******
************************************************************   0.0   0.0   0.0   0.0   0.0   0.0************
************************************************************   0.0   0.0   0.0   0.0   0.0   0.0************
******************************************************************   0.0   0.0   0.0   0.0******************

THE TOTAL SUMMATION OF THE DIFF.(SIM.-OBS.) IS      163.10FT.
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SIMULATED-OBSERVED ELEVATIONS IN THE GRAND PRARIE IN THE YEAR 1982 IN FT.

*******	5.5	8.4	1.5	-1.7	0.8	4.1	4.8	*******	*******	*******	*******	*******	*******	*******	*******	*******
5.6	10.8	11.7	-0.5	2.7	-4.3	3.8	1.8	4.3	*******	*******	*******	*******	*******	*******	*******	*******
9.6	5.9	1.8	0.8	4.1	1.9	0.5	-2.6	1.0	4.2	*******	*******	*******	*******	*******	*******	*******
10.9	7.7	-1.6	-1.3	-0.1	0.4	1.5	-6.5	-8.2	0.8	*******	*******	*******	*******	*******	*******	*******
9.1	11.3	3.5	0.3	-0.5	-1.6	-0.7	-8.8	-5.1	1.2	2.2	*******	*******	*******	*******	*******	*******
*******	8.8	3.8	3.0	0.2	-1.6	-0.1	-1.0	7.6	7.9	4.0	3.0	*******	*******	*******	*******	*******
*******	6.9	3.5	6.9	2.9	3.7	2.0	-0.7	4.5	5.5	3.2	4.3	3.2	*******	*******	*******	*******
*******	*******	8.3	9.1	4.4	4.3	3.9	-1.1	0.6	2.0	4.4	3.6	2.8	*******	*******	*******	*******
*******	*******	*******	*******	7.5	2.9	0.7	2.4	4.5	1.1	3.6	3.9	-0.1	2.8	*******	*******	*******
*******	*******	*******	*******	*******	5.1	1.4	-3.3	0.5	-2.2	-0.5	0.8	-2.1	3.1	*******	*******	*******
*******	*******	*******	*******	*******	*******	5.4	1.4	-0.5	-3.6	-0.4	0.1	-2.8	0.9	2.9	*******	*******
*******	*******	*******	*******	*******	*******	6.5	2.1	-0.8	-2.2	-0.2	0.8	-2.1	-0.4	-1.4	2.2	*******
*******	*******	*******	*******	*******	*******	4.7	4.2	0.2	-0.4	1.1	5.7	-1.0	-0.5	-3.9	-3.1	0.4
*******	*******	*******	*******	*******	*******	*******	-0.5	6.8	4.9	2.2	5.2	1.8	1.0	-0.3	-1.8	0.8
*******	*******	*******	*******	*******	*******	*******	2.4	4.0	4.4	0.5	3.3	6.2	3.8	2.3	-0.3	-1.8
*******	*******	*******	*******	*******	*******	*******	3.0	1.7	6.7	2.0	2.7	4.4	3.0	4.2	0.5	-0.9
*******	*******	*******	*******	*******	*******	*******	*******	2.3	5.8	1.5	2.4	6.7	3.3	2.3	0.9	1.9
*******	*******	*******	*******	*******	*******	*******	*******	*******	-1.2	-4.4	1.6	5.7	6.0	2.6	2.9	5.2
*******	*******	*******	*******	*******	*******	*******	*******	*******	*******	-1.5	-3.2	0.4	2.7	3.2	3.7	5.3
*******	*******	*******	*******	*******	*******	*******	*******	*******	*******	2.2	-2.9	-5.6	-4.7	0.2	3.4	*******
*******	*******	*******	*******	*******	*******	*******	*******	*******	*******	8.0	-4.0	-5.5	-1.7	0.4	3.6	*******
*******	*******	*******	*******	*******	*******	*******	*******	*******	*******	*******	4.9	2.3	3.4	3.2	*******	*******

SUMMATION OF DIFFERENCE (SIM-OBS) 421.09 IN FT.

DIFFERENCE (SIMULATED-OBSERVED) SAT. ELEV. IN THE YEAR 1982 IN FT.

***	0.0	0.0	1.5	0.0	0.0	0.0	4.8	***	***	***	***	***	***	***	***	***	***
0.0	1.7	11.7	-0.5	2.0	-4.3	3.8	1.8	4.3	***	***	***	***	***	***	***	***	***
0.0	5.9	1.8	0.6	4.1	1.9	0.5	-2.6	1.0	4.2	***	***	***	***	***	***	***	***
10.9	7.7	-1.6	-1.3	-0.1	0.4	1.5	-6.5	-8.2	0.0	***	***	***	***	***	***	***	***
9.1	11.3	3.5	0.3	-0.5	-1.6	-0.7	-8.6	-5.1	1.2	0.0	***	***	***	***	***	***	***
***	3.8	3.8	3.0	0.1	-1.8	-0.1	-1.0	7.5	7.9	0.0	0.0	***	***	***	***	***	***
***	6.9	3.5	6.9	2.9	3.7	2.0	-0.7	4.5	5.5	0.0	0.0	0.0	***	***	***	***	***
***	***	6.3	9.1	4.-	4.3	3.9	-1.1	0.6	2.0	4.-	3.6	2.6	***	***	***	***	***
***	***	***	***	7.5	2.9	0.7	2.4	4.5	1.1	3.6	3.9	0.0	0.0	***	***	***	***
***	***	***	***	***	0.0	1.2	-3.3	0.5	-2.2	-0.5	0.8	-2.1	0.0	***	***	***	***
***	***	***	***	***	***	0.0	0.0	-0.5	-3.5	-0.4	0.1	-2.8	0.0	0.0	***	***	***
***	***	***	***	***	***	0.0	0.0	-0.8	-2.2	-0.2	0.8	-1.7	-0.4	0.0	0.0	***	***
***	***	***	***	***	***	0.0	0.0	0.2	-0.4	1.1	5.7	-1.0	-0.5	-2.4	0.0	0.0	***
***	***	***	***	***	***	***	0.0	5.8	4.9	2.2	5.2	1.8	1.0	-0.3	0.0	0.0	0.0
***	***	***	***	***	***	***	0.0	0.0	0.0	0.5	3.3	6.2	3.8	0.0	0.0	0.0	0.0
***	***	***	***	***	***	***	0.0	0.0	0.0	2.0	2.7	4.4	0.0	0.0	0.0	0.0	0.0
***	***	***	***	***	***	***	***	0.0	0.0	1.5	2.4	6.7	3.3	0.0	0.0	0.0	0.0
***	***	***	***	***	***	***	***	***	0.0	0.0	0.0	5.7	0.0	0.0	0.0	0.0	***
***	***	***	***	***	***	***	***	***	***	0.0	0.0	0.0	0.0	0.0	0.0	0.0	***
***	***	***	***	***	***	***	***	***	***	0.0	0.0	0.0	0.0	0.0	0.0	***	***
***	***	***	***	***	***	***	***	***	***	0.0	0.0	0.0	0.0	0.0	0.0	***	***
***	***	***	***	***	***	***	***	***	***	***	0.0	0.0	0.0	0.0	***	***	***

THE TOTAL SUMMATION OF THE DIFF.(SIM.-OBS.) IS 243.10FT.

APPENDIX F

Simulated Minus Observed Ground Water Levels

(Using a Varying Effective Porosity)

SIMULATED-OBSERVED ELEVATIONS IN THE GRAND PRARIE IN THE YEAR 1977 IN FT.

*	3.9	3.4	8.3	9.8	9.7	2.4	-0.3	*	*	*	*	*	*	*	*	*	*
4.0	-4.0	-0.3	0.8	-1.5	-1.5	-1.6	-1.8	1.1	*	*	*	*	*	*	*	*	*
1.9	-6.8	-1.0	-2.8	-0.9	-2.8	-4.4	-3.3	-0.7	1.9	*	*	*	*	*	*	*	*
2.0	-1.6	-3.8	-5.8	-1.6	-2.5	-1.0	2.3	3.0	5.1	*	*	*	*	*	*	*	*
2.2	3.5	2.7	0.0	0.4	-0.4	1.1	4.3	5.5	1.9	2.2	*	*	*	*	*	*	*
*	3.9	1.2	3.5	2.9	2.7	5.1	4.9	2.4	2.8	1.3	1.1	*	*	*	*	*	*
*	1.0	-2.4	3.7	4.1	3.9	4.7	1.4	2.8	3.3	0.2	1.0	0.4	*	*	*	*	*
*	*	0.6	0.0	-0.2	1.3	-1.0	-3.6	-1.2	0.4	-0.3	-1.4	0.5	*	*	*	*	*
*	*	*	*	-0.7	-2.2	-2.9	-0.6	0.0	-3.8	-0.3	-0.5	-3.8	0.2	*	*	*	*
*	*	*	*	*	-1.4	-3.1	-5.1	-1.1	-5.5	-4.6	-2.1	-5.2	0.6	*	*	*	*
*	*	*	*	*	*	-1.1	-6.5	-1.4	-3.7	-1.5	-0.9	-4.3	-3.2	1.0	*	*	*
*	*	*	*	*	*	-0.7	-8.1	-1.5	-1.7	-0.6	0.1	-2.2	-2.8	-4.0	1.0	*	*
*	*	*	*	*	*	0.4	-3.9	-1.8	-0.9	-1.3	2.2	-2.2	-2.4	-5.6	-5.4	2.6	*
*	*	*	*	*	*	*	2.1	1.8	1.0	-0.4	2.0	-0.8	-0.3	-2.9	-7.7	-3.9	2.6
*	*	*	*	*	*	*	3.5	-1.9	-1.6	-1.4	0.9	2.8	0.7	-3.5	-8.4	-2.6	4.5
*	*	*	*	*	*	*	3.3	-4.4	-1.4	-2.2	-0.8	0.3	-2.6	-2.8	-6.6	-0.2	5.8
*	*	*	*	*	*	*	*	0.0	-2.9	-6.9	-3.0	2.8	-2.1	-3.5	-2.6	2.8	6.1
*	*	*	*	*	*	*	*	*	-1.3	-11.2	-6.7	-1.1	-1.5	-2.1	0.7	5.4	*
*	*	*	*	*	*	*	*	*	*	-0.7	-13.4	-11.3	-6.7	-4.1	2.2	5.7	*
*	*	*	*	*	*	*	*	*	*	0.3	-10.1	-13.8	-10.9	-2.4	4.8	*	*
*	*	*	*	*	*	*	*	*	*	-7.1	-14.0	-14.4	-3.6	0.7	-4.1	*	*
*	*	*	*	*	*	*	*	*	*	*	-3.1	6.0	5.7	2.2	*	*	*

SUMMATION OF DIFFERENCE (SIM-OBS) -154.60 IN FT.

SIMULATED-OBSERVED ELEVATIONS IN THE GRAND PRARIE IN THE YEAR 1982 IN FT.

	5.5	8.4	1.5	-1.7	0.8	4.1	4.8										
5.6	0.8	3.8	-4.6	-4.4	-12.1	1.0	0.0	4.3									
9.6	-6.9	-5.7	-3.7	-1.2	-2.8	-1.9	-4.6	0.2	4.2								
10.9	-1.2	-10.1	-6.6	-4.3	-3.4	-1.2	-9.5	-10.6	0.8								
9.1	5.6	-1.5	-4.2	-4.0	-4.8	-3.2	-11.5	-8.9	-1.8	2.2							
	8.8	-0.7	-1.1	-3.4	-4.4	-2.1	-3.6	2.6	4.4	1.1	3.0						
	6.9	-0.4	4.2	-0.3	2.2	-1.3	-3.9	1.8	2.1	-2.5	1.6	3.2					
		8.3	9.1	2.4	2.4	1.7	-4.5	-3.5	-2.0	1.2	1.4	2.8					
				7.5	1.1	-1.8	-1.1	0.3	-3.2	0.3	1.0	-2.8	2.8				
					5.1	-1.5	-8.3	-4.3	-6.0	-3.9	-2.6	-5.9	3.1				
						5.4	-11.4	-6.5	-7.5	-3.5	-3.5	-7.8	-3.2	2.9			
						6.5	-14.9	-7.2	-5.7	-3.6	-2.5	-7.2	-6.2	-6.2	2.2		
						4.7	-8.3	-5.1	-4.1	-2.5	2.4	-5.1	-6.2	-10.6	-8.3	0.4	
							-0.5	0.3	-1.4	-2.0	1.6	-2.0	-3.6	-6.9	-9.3	-2.3	4.0
							2.4	-6.1	-10.6	-4.9	-0.6	1.9	-1.7	-7.6	-9.3	-6.2	2.5
							3.0	-7.5	-8.7	-4.7	-2.6	-1.5	-5.7	-5.1	-7.7	-5.5	2.5
								2.3	-6.2	-7.6	-4.6	0.2	-3.4	-6.2	-5.3	-0.8	4.2
									-1.2	-14.7	-13.4	-3.3	-0.8	-3.9	-1.2	5.2	
										-1.5	-23.0	-17.1	-9.8	-5.1	0.4	5.3	
										2.2	-15.7	-21.2	-16.9	-6.5	3.4		
										8.0	-11.2	-15.4	-8.6	-3.9	3.8		
											4.9	2.3	3.4	3.2			

SUMMATION OF DIFFERENCE (SIM-OBS) -444.00 IN FT.